REMARKS

Claims 30-46 are pending. By this Amendment, claims 30 and 39 are amended.

Applicants thank Examiner Wong for the courtesies extended during the February 24, 2005 personal interview. Applicants' separate record of the substance of the interview is incorporated into the following remarks.

Claims 30-38 are rejected under 35 U.S.C. §103 over Melcher et al. in view of Ellingson et al. In addition, claims 39-46 are rejected under 35 U.S.C. §103 over Melcher in view of Ellingson. Applicants respectfully traverse the rejections.

Claims 30 and 39 are directed to an apparatus for electrodeposited film formation. The apparatus of each claim comprises an electrolyte solution bath holding an electrolyte solution and an object to be treated; and a laser whose pulse width is less than a picosecond and which irradiates at least part of the object to be treated to thereby excite hot electrons in the laser-irradiated part and form the electrodeposited film thereon. The laser of claim 30 is a mode-locked laser. The laser of claim 39 is a pulse laser with an electric field in the order of tens of GW/cm^2.

By using a pulse laser having a pulse width of less than a picosecond, a state of non-equilibrium between the electrons and a grid in either temperature or energy can be realized particularly in a surface part of the object to be treated. As a result, electrons can be heated to high temperature without inviting the generation of phonons (grid vibration = heat). In this state of non-equilibrium, the whole luminous energy can be regarded as being given to the electrons. Page 6, lines 17-26.

In the invention, hot electrons generated in this manner are taken out of the surface of the object to be treated, and the hot electrons so taken out are used for forming an electrodeposited film, by, for example, metal-plating. As a result, the invention allows plating without relying on thermo-electromotive force. Page 6, line 27-page 7, line 5. Since no grid

vibration, that is, heat, arises, overhangs on the edges of plating, which are inevitable by the conventional method of partial plating using the thermo-electromotive force generated by laser irradiation, can be prevented. Therefore, an improved aspect ratio at the end part of the plating can be expected. Page 7, lines 6-13.

With a pulse laser whose pulse width is in the order of nanoseconds, electrons and the grid reach a thermal equilibrium during irradiation with the pulse laser, resulting in partial consumption of luminous energy by the grid vibration and a consequent drop in the efficiency of energy utilization. In contrast, where plating is formed by hot electrons taken out before the above-noted thermal relaxation occurs, the energy of the pulse laser is efficiently utilized for plate formation, allowing use with a low output laser. Page 7, lines 14-23. See also Figures 1 and 2 and the description thereof at page 11, line 17, to page 14, line 5, and the embodiments.

Melcher is directed to a method for high resolution maskless electroplating. Example II utilizes a laser beam pulsed by mechanical chopping to form a pulse of light for 0.3 milliseconds. Col. 5, lines 23-26. Melcher teaches that the intensity of the light in all cases should be sufficient to provide a beam with an intensity preferably between about 10^2 to 10^6 to W/cm^2. Col. 3, lines 48-50. In addition, Melcher teaches that the upper limit should be chosen so as to avoid thermal transformations of the structure of the cathode. In general, Melcher teaches that this will limit the maximum power input to about 10^6 W/cm^2, which corresponds to 10^{-3} GW/cm^2, for exposures longer than microseconds and proportionally higher powers for shorter pulse durations. Col. 3, lines 57-62.

Melcher does not teach or suggest the mode-locked laser of claim 30. In addition, Melcher does not teach or suggest a pulse laser with an electric field in the order of tens of GW/cm^2, as recited in claim 39. Furthermore, Melcher does not teach or suggest a laser with a pulse width of less than a picosecond, which generates hot electrons in the laser-irradiated

part, or that such a laser can more efficiently utilize the laser energy and/or provide for an improved aspect ratio, as discussed above.

Ellingson teaches a femtosecond pulsed laser, such as an argon-pumped mode-locked Ti:sapphire laser. Col. 6, lines 5-6. Ellingson does not, however, provide any motivation to utilize this femtosecond laser in electroplating, as described in Melcher. In particular, Ellingson does not teach or suggest that a femtosecond laser in an apparatus described in Melcher will more efficiently utilize the laser energy and provide for an improved aspect ratio.

Melcher does not teach or suggest all of the features of claims 30 and 39. In addition neither Melcher nor Ellington provide any motivation to replace the laser described in Melcher with the femtosecond laser described in Ellingson. Therefore, the rejections over these references should be reconsidered and withdrawn.

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 30-46 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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